

Origins and Land-Sea Interactions of ClNO₂ At Four Locations Of China: Insights Into The Prolonged Impact of Oceanic Chlorine on The Continent

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Abstract

Nitryl chloride (ClNO₂), a key reactive chlorine compound, profoundly impacts atmospheric chemistry and climate. However, identifying its sources presents challenges due to limited field observations and the absence of an effective method to differentiate complex oceanic and continental sources. In this study, we conducted intensive field observations in four representative regions with elevated atmospheric chlorine activity across China: Xi'an, Wangdu, Qingdao, and Hong Kong. Our results reveal significantly higher concentrations of ClNO₂ in coastal areas compared to inland locations, primarily due to additional input of oceanic Cl⁻. Moreover, ClNO₂ concentrations in North China exceed those in the South, indicating the significant impact of anthropogenic emissions from continental regions. These findings underscore the significant contribution of both oceanic and continental chlorine to the high ClNO₂ levels in coastal areas. To further distinguish the origins of ClNO₂, we developed isotopic technology to quantitatively analyze the intensive interaction of ClNO₂ in coastal areas, emphasizing the role of ocean-derived chlorine in extending its atmospheric lifetime and transport range over the continent, where serious atmospheric pollutants prevail. This study lays the groundwork for isotopic techniques to trace the origins of reactive chlorines in the atmosphere, which significantly advances our understanding of atmospheric chlorine sources.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

ACAM: Atmospheric Chemistry and the Asian Monsoon, TOAR: Tropospheric Ozone Assessment Report

IGAC Regional Working Groups

China Working Group